

**National Aeronautics and Space Administration  
Washington, DC**

**NASA ADVISORY COUNCIL**

**April 28-29, 2010**

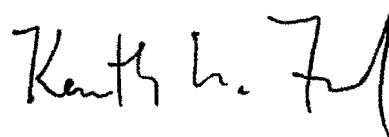
**NASA Johnson Space Center  
Gilruth Conference Center, Lonestar Room  
2101 NASA Parkway  
Houston, Texas**

**MEETING MINUTES**



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**P. Diane Rausch  
Executive Director**



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**Kenneth M. Ford  
Chair**

**NASA ADVISORY COUNCIL  
NASA Johnson Space Center  
Gilruth Conference Center, Lonestar Room  
2101 NASA Parkway  
Houston, Texas  
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**Meeting Report  
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*Meeting Report Prepared By:  
David J. Frankel*

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Gilruth Conference Center, Lonestar Room  
2101 NASA Parkway  
Houston, Texas  
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*April 28, 2010*

Call to Order, Announcements

Ms. Diane Rausch, NASA Advisory Council (NAC) Executive Director, called the meeting to order and welcomed the NAC members and attendees to Houston, Texas, and the Johnson Space Center (JSC). She reminded everyone that the meeting was open to the public and held in accordance with the Federal Advisory Committee Act (FACA) requirements. All comments and discussions should be considered to be on the record. The meeting minutes will be taken by Mr. David Frankel, and will be posted to the NAC web site([www.nasa.gov/offices/nac/](http://www.nasa.gov/offices/nac/)) shortly after the meeting. All of the NAC members are serving as experts in their fields and as Special Government Employees. They are subject to ethics regulations, and will recuse themselves from discussions on any topic in which there could be a potential conflict of interest involving themselves or their employers. Any questions should be directed to Ms. Rausch.

Remarks by Council Chair

Dr. Kenneth Ford, Chair of the NAC, welcomed everyone to the third meeting of the recently restructured NAC. He thanked NASA JSC for hosting the meeting and stated that the NAC members had an outstanding tour of the facility the previous day. He then introduced the JSC Director, Mr. Michael Coats.

Welcome to NASA Johnson Space Center

Mr. Coats welcomed everyone to the Center and described its current situation. They are anxious to maintain their core competencies and skills. He noted that the Center's most important capability resides in the people who work there and encouraged the NAC members to speak individually with the JSC employees. Mr. Coats observed that the teamwork is better at JSC and NASA-wide than ever before. In response to a question from Col. Eileen Collins, he described the job situation. The Center has been laying off people (contractors, not civil servants) since last October. He is concerned about what he refers to as the "acquisition gap." In accommodating the Administration's new direction, JSC hopes to restructure, rather than terminate. There are 3,000 people employed at JSC on the Space Shuttle program and 1,500 employed on the Constellation program, and he had hoped to move many of the Shuttle people to Constellation. Constraints are imposed by the budget and procurement processes and they are looking at using aggressive acquisition plans to smooth the transition effort. Mr. Coats was asked how the astronaut corps is kept together without any prospect for space flight. Astronauts will continue to be flying to the International Space Station (ISS). There will be launches every three months, four times a year to keep two U.S. astronauts and two Russian cosmonauts on the ISS at all times. However, he anticipates that by the last Shuttle mission, the Astronaut Office will be down to around 50 astronauts.

Mr. Coats described JSC's Innovation Council, which was established when he became Center Director. He observed one advantage particular to NASA: other agencies, academia, and business like to talk to NASA and this helps with benchmarking. Innovation is stressed at JSC and they like to get the young people involved. Ms. Esther Dyson asked about the biggest mistake someone has made being innovative. Mr. Coats responded that there haven't really been any mistakes. He added that program management is one of the hardest things done at the Center, and that it is important to allow people to make mistakes. The best Program Managers are those who have been through the "fire." Mr. Coats allowed that he prefers a Program Manager who has made mistakes because you learn from your failures. He believes you should not tell people not to take risks.

In response to a question from Dr. Charles Kennel, Mr. Coats described the effect that the ISS life extension will have on the development and utilization of the National Laboratory. They are concerned about getting necessary logistics up to the ISS. Commercial transport is not ready and will not be ready

when they said they would. Mr. Coats stated that he is not sure what new programs and projects they are going to have at JSC. Mr. Bolden has said, "Let's share the work around all the Centers." That is important for public support. Mr. Brett Alexander asked whether Commercial Crew transport will work and what Johnson's role would be. Mr. Coats responded that Mr. Bolden has made it clear we are going to make sure it is safe before we fly our astronauts. The concern is Commercial Cargo transport was supposed to be ready years ago and it is not ready yet. We are going to pay the Russians for years to fly our astronauts. They've already doubled the price and it will probably go up again. Mr. Alexander asked Mr. Coats whether the Commercial launch vehicles would be ready before Constellation would have been. Mr. Coats responded that schedule largely depends on the funding. He stated that his biggest concern is how to maintain a space program across multiple administrations and Congresses. There have been 20 cancelled programs in the last 20 years. It is an amazing political achievement that the ISS was built. It is important to get young people to study math and engineering, but we are not creating a great environment for those fields. To be globally competitive, we must do that. Mr. Richard Kohrs asked about the attrition rate for civil servants and new hires. Mr. Coats stated that they have a personnel ceiling and have been staying at it. Due to the recession, not as many people have been leaving; he can't get the people on Shuttle and Constellation to move.

Mr. Miles O'Brien suggested that the fact that the ISS is multinational may have ensured that it was built, because we can't walk away from it; he asked whether that is a model that should be retained. Mr. Coats responded that a core competencies team is working with our international partners. In the previous Administration there was a reluctance to put them into the critical path. Ironically, the U.S. has turned out to be the most unreliable partner. He advised that any space endeavor should be international because those projects are harder to cancel.

Dr. Ford thanked Mr. Coats for taking the time to spend with the Council.

#### NASA Administrator Remarks

Mr. Charles Bolden, NASA Administrator, began by discussing how very important diversity and inclusion is to the Agency. It used to be called equal opportunity. It is more than race and ethnicity; it is also cultural and geographic diversity. If you look at the map of the NASA workforce now, we are starting to see employees from across a broad spectrum of states and territories, with Puerto Rico being a prime example. He observed that our individual backgrounds suggest what is important to each of us; for example, his attitude towards personal security is probably different than that of most of the Council members. Diversity and inclusion is very important and some Centers are better at it than others.

Mr. Bolden was pleased that the Council members had the opportunity to tour JSC because technology doesn't mean anything unless you see it. He had previously thought that the Japanese were ahead in robotics until JSC's Chief Engineer told him that NASA was a world leader and showed him an incredible humanoid robot ("Robotnaut 2"). This robot, jointly developed with GM, may take the place of workers on some auto assembly lines where there are high risks of serious injury.

Mr. Bolden observed that "terminate" is a powerful word. He stated that we are going to find ourselves in a gap because it takes a year to spend money once we get a budget. He explained that the government procurement process in the U.S. is broken and that it takes 10 years to bring a new program into existence. This makes it beneficial to rely on a commercial entity that is not stuck with the every two-year-change-government mode. They don't have to go through the hassles and inefficiencies of the government procurement process. Mr. Bolden believes we can make them successful. The most difficult thing will be to make everyone understand the critical importance of safety. He added that failure is highly undesirable, but yet we have to take risks.

Mr. Bolden noted that the U.S. does not own the ISS. We are the major partner, but we cannot unilaterally decide what to do. There are five votes. After 2015, the ISS will remain in operation. Every other partner, except the U.S., is talking to China. It is fantasy to think we can isolate China; the party that will be isolated will be the U.S. Some members of Congress want to have nothing to do with China. He stated that his NASA leadership team is not divided. They are not resisting the President's guidance. We are in a pre-decisional period right now. He encourages informed, pre-decisional dissent and wants to make sure that

when a decision is made that everybody has been heard. He explained that no plan survives crossing the line of departure. The President has a plan and Congress has a role to play. The informed consent of Congress is needed. They understand that the worst thing would be a Continuing Resolution. Industry is critical and one of the most important industries is the media. The Education and Public Outreach Committee was formed because we haven't done well in this area. Mr. Bolden stated that he intends to start working more with the media.

Mr. Bolden described astronauts as a special group of people and explained that today's astronauts are really different because they know that there will be no short missions. The missions now are six months long. They know something can go wrong. With a six-person crew on board, the ISS is like an old house; some technology on board is from the 1970s. Three crewmembers are constantly doing maintenance, while the other three are doing good science. There is an incredible future for young men and women who want to have a career in space. The Shuttle had an incredible upmass capacity, but winged vehicles don't work well for space missions beyond Low Earth Orbit (LEO); that's why we went to a conical shaped vehicle. Rockets have to comply with the rocket equation and physics. We think we've solved first stage propulsion; the revolution will be getting its cost down. He needs the Council to be critical and also give him good news. Mr. Bolden concluded by reemphasizing his appreciation to the Council members for chairing their committees and how extremely important it is to have "informed dissent."

Dr. Ford thanked Mr. Bolden for sharing his time with the Council

#### NASA Workforce – Recent NASA Hiring Patterns

Dr. Ford introduced Ms. Toni Dawsey & Mr. Stephen Chesley, Office of Human Capital Management, NASA Headquarters. He noted that this presentation covers a priority problem given to the NAC by Mr. Bolden and attempts to answer the questions: Where does your workforce come from and are you geographically diverse in your hiring? Their study concerned three groups of hires: cooperative education (co-op) hires, new hires, and fresh-out-from-school hires. Mr. Chesley presented charts showing NASA hires by type since 2005. He explained that most science and engineering hires come from the contractor workforce. He was not sure whether contractor workforce included both universities and business. He noted that last year was an anomaly in which the number of new hires was kept down by an economy that discouraged employees from leaving the Agency. In response to Dr. Huntress' observation that the Jet Propulsion Laboratory (JPL) was not included in the data, Mr. Chesley stated that he did not have access to their data. Dr. Ford noted that the next NAC meeting will be at JPL and will cover this topic from JPL's perspective. Ms. Dyson requested information on how many hires come from outside the NASA family. Dr. Ford stated it would be useful if engineers and scientists could be culled from the data. Mr. Chesley reviewed several charts showing hiring data from different perspectives from the various NASA Centers. Essentially the data showed very local hiring patterns and relatively poor geographical diversity at most Centers.

Gen. Edmonds explained that geographical diversity is important from a political perspective. Mr. Hanisee observed that students attending each university come from diverse geographical locations. Dr. Kennel stated that enrollment from foreign countries in engineering is almost 50% of the total. Dr. Ford explained that when the Agency is in a low-hiring period and most hiring is co-op, there is a natural local selection pool. Ms. Dyson was concerned about the data presented and hoped that the NASA Centers could do a better job reaching out to the rest of the country. Mr. Kohrs asked for the goal to be identified. Ms. Dyson stated they need to reach out more. Dr. Ford stated that the Centers should as much as possible draw from a national talent pool. Mr. Kohrs suggested this would be achieved (from an Agency wide perspective) by using the "10 healthy Centers" concept. Gen. Edmonds advised that from a political posture, more than 10 Centers are needed. You need to make NASA look larger than just 10 states. You can't do it overnight, but you can do it over time. It is important to show jobs in as many Congressional districts as possible. Mr. O'Brien asked whether NASA encourages employees to go from Center to Center, noting that it would alleviate unwanted concentrations. Mr. Chesley responded that it is not discouraged, but not common. Mr. Kohrs asked whether NASA was being proactive. Mr. Chesley answered that most of the recent hiring is replacement hiring, which forces NASA to hire someone who can jump right in, which generally calls for local recruitment. Mr. Chesley concluded by stating that more work needs to be done in this area, and that it is partially from diversity (of all kinds) that we become more innovative.

Dr. Ford thanked Mr. Chesley for an excellent presentation. He observed that there is a lot of information in the data that was presented. Ms. Dyson volunteered her committee to follow-up on this important issue. She also explained how important it is to keep people fresh and be innovative in human resources practices. Dr. Ford noted that the NASA "Fed Traveler" system (the government travel software) sends the message to NASA employees that they don't matter. It is one of the worst systems he has ever experienced; it is a major problem and by normal standards it is essentially unusable. Ms. Dyson stated that it is an impediment to people being able to work. Mr. Kohrs suggested constraining promotions beyond a specific grade-level unless a person has worked at more than one Center. Dr. Ford stated that this issue of what appears to be largely local hiring practices around each Center is a complicated and multifaceted issue that will require further study and analysis.

#### NASA Office of Chief Technologist

Dr. Ford introduced Dr. Robert D. Braun, Chief Technologist, NASA Office of Chief Technologist (OCT), who has been at NASA Headquarters for approximately three months. Dr. Braun described the OCT's responsibilities. They include advising on Agency-wide technology policy, managing the Space Technology Program (STP), coordinating technology investments across the Agency, changing culture towards creativity and innovation in regard to workforce development and other areas, and leading commercialization opportunities. He described the shifts taking place due to the President's FY 2011 budget request for NASA. He explained that the goal of NASA's human spaceflight program is to extend human presence beyond LEO. The budget request takes a new approach to this goal, focusing on developing the technological capabilities required for humans to reach multiple destinations, including the Moon, near-Earth asteroids, Lagrange points, and Mars. He explained that NASA's near-term investments seek to create the knowledge and capabilities needed for humans to venture beyond LEO safely and efficiently. The new approach seeks to change the game by expanding the alternatives available for human exploration through timely, strategic, and significant technology investment. Dr. Braun noted that many reports from outside NASA make this same recommendation and have a common theme: research and technology is important and should be managed outside NASA's Mission Directorates. The 2008 NASA Authorization Act states that a robust program of long-term exploration-related research and development will be essential. A 2009 National Resource Council (NRC) report called for NASA to revitalize its advanced technology development program with a Defense Advanced Research Projects Agency (DARPA) – like organization within NASA. The 2009 Augustine Committee Report states that it is time for NASA to reassume its crucial role of developing new technologies for space and asserts that the alternatives available are limited due to a lack in strategic investment in technology development in past decades. Dr. Braun observed that it is not hard to identify technologies that are needed. The same technology needs have been identified and recommended repeatedly in reports going back to 1969. Dr. Braun has investigated the reason for the recommendations not being implemented. He believes that the reason for the lack of accomplishment is due to not having a sustained and focused investment. Dr. Ford explained that a constancy of *purpose* is essential for a technology program to be sustainable and that technology programs are at risk if NASA cannot convincingly link the technology programs to the national purpose they serve. He continued that all too often, technology programs end-up serving as a "bank" which gets raided whenever there is a financial shortfall elsewhere in the agency.

Dr. Braun stated that they are building a technology-enabled exploration strategy. Its base is early innovation and foundational research efforts using seed money. From this they will build a steady cadence of technology demonstrations. He explained that the President's budget request gives guidance on this. Formerly, a planned return to the moon was a filter on all investments. Now, there are destinations that can be used to drive a technology development program. The capabilities that are needed are hard and there is a need to get started on them now. NASA will invest in multiple competing technologies and then down-select. Dr. Braun does not see an end to space flight in the President's budget; he sees a rebalancing in NASA's core competencies: research and technology, spaceflight hardware development, and mission operations. Col. Collins expressed concern over whether NASA is failing to reach out to businesses. Dr. Braun responded that the Administration is now encouraging NASA to seek out partnership opportunities with business. NASA is now part of the research and development engine that the Administration believes will fuel the recovery. NASA is being asked to do that through partnerships with academia, industry, small and large business, and other U.S. Government agencies. Mr. Alexander advised that it would be unlikely

for these partnerships to augment NASA's budget. Ms. Marion Blakey observed that the aerospace industry is having a hard time holding onto their engineers. Dr. Braun responded that NASA will be flying things every year, except next year, and added that there is a significant benefit to a large number of small projects. Dr. Braun showed a slide demonstrating that a human mission to Mars without new technology would require starting with a mass in LEO equal to 12 International Space Stations. Dr. Ford stated that Mars is not practically obtainable without new technologies and new mission concepts. Dr. Braun suggested that Phobos, a moon of Mars, as the destination for a human exploration mission is much more feasible due to its low gravity. Dr. Ford concurred and Dr. Huntress asserted that to just throw Mars on the table as a goal is not credible. t

Dr. Braun described the plan for integrated "push/pull" technology programs. The STP will push the development of game-changing technologies, while the Exploration Systems Mission Directorate (ESMD) will engage in enabling technology programs that pull the development of new technologies. Dr. Braun described the foundational principles for the STP. It will advance non-mission-focused technology and produce technology products for which there are multiple customers. They are building a set of potential DARPA-like grand challenge goals, such as preventing orbital debris, engineering faster space vehicles, and discovering life beyond Earth. Dr. Braun concluded by stating that a NASA focused on technology and innovation will drive the Nation's economic competitiveness, motivate young people to pursue Science, Technology, Engineering, and Math (STEM) degrees and careers, and enable NASA to apply its intellectual capital to develop technological solutions addressing the Nation's broader needs in energy, weather & climate, Earth science, health & wellness, and national security.

Dr. Ford expressed pleasure in seeing the program's development and thanked Dr. Braun for his presentation.

#### Aeronautics Committee Report

Dr. Ford introduced Ms. Blakey, Aeronautics Committee Chair, to report on the Committee's activities. Ms. Blakey briefed the Council on Unmanned Aircraft Systems (UAS) research. The need to fly UAS in the National Airspace System (NAS) is becoming more urgent for missions important to defense, national security, emergency management, and science. UAS are unable to routinely access the airspace due to inadequate separation assurance and conflict avoidance, communication technology, pilot-vehicle interfaces, and standardized safety. All current aviation regulations are based on a pilot being on board. She described NASA's UAS initiative, which is funded at \$30M in the FY2011 President's budget. It will enable key technologies and procedures to be developed that are needed for UAS to be operated and integrated in the NAS. This integration is a key challenge for the NextGen Air Traffic Control System. NASA will work with the FAA and DOD to support their focus on the UAS access problems.

Ms. Blakey briefed the Council on verification and validation (V&V) research. She explained that the V&V of Flight Critical Systems (FCS) initiative, funded at \$20M, will enable NASA to provide technical leadership for advancing V&V capabilities, which is a major gap to realizing the NextGen vision. Research objectives include reducing barriers to innovation associated with safety V&V. She explained that developers do not have effective ways to model software complexity. Developers also lack efficient ways to test, validate, and certify that software-based systems will perform reliably, securely and safely, particularly under attack or in partial failure. Fundamental research is needed to create the foundations for practical certification standards for new technologies. She observed that V&V can cost more than all other design and implementation costs combined, thereby preventing some novel operations and technologies from being developed.

Ms. Blakey presented a proposed Council Observation on UAS oversight by the Aeronautics Research Mission Directorate (ARMD). The Council approved the following Observation: "The Council endorses ARMD taking on the important problem of UAS operations in the NAS."

Ms. Blakey presented a proposed Council Observation on verification and validation oversight by ARMD. Dr. Ford expressed a concern that there be a focus on some particular aspect that is narrow enough for NASA to make a difference given the funding for this effort. Ms. Blakey agreed to follow-up on his suggestion.

Ms. Blakey described the Aeronautics Test Program (ATP) strategy. ATP is committed to ensuring aeronautics test capabilities for the nation. NASA does not plan to own and operate all test facilities needed. ATP will ensure that NASA can access those facilities through strategic partnerships. ATP will focus on national-class test capabilities. She explained that NASA has a role in providing test capabilities that are not economically viable as an independent business and thus not available elsewhere. She noted that a test facility can support R&D as well as test and evaluation (T&E) activities. Ms. Blakey described NASA's ATP wind tunnels and similar assets, which are located at Ames Research Center, Glenn Research Center, Langley Research Center, and Dryden Flight Research Center. NASA is the largest user. The facilities in many cases are underfunded and deteriorating. She presented a chart showing how ATP use by commercial customers has declined by 11,000 hours since 2003, representing a \$34M loss in revenue.

Ms. Blakey presented a proposed Council Recommendation for an Agency-wide strategy to stabilize the situation. In response to a question from Mr. Alexander, Ms. Blakey explained that the decline is partly attributable to a move to computer simulation. She noted that there are data point divergences when wind tunnel results are compared to computer simulations. Dr. Ford observed that fewer new aircraft systems are being developed and hence less demand for wind tunnel time. Ms. Blakey agreed and added that some wind tunnel testing has gone abroad. Dr. Ford explained that NASA has an Agency-wide facility problem and that wind tunnels are very expensive to operate and maintain. Dr. Kennel suggested that the recommendation be revised to emphasize its urgency. Dr. Ford suggested changing the word "strategy" to "plan." The Council approved the following Recommendation: "During the review of the Aeronautics Test Program (ATP), the Aeronautics Committee noted a decreasing utilization trend of ATP facilities that if left unabated will result in an increasing budget shortfall affecting the operations of these facilities. The Council recommends that an Agency-wide plan be developed to stabilize and where possible reverse the situation including supporting and improving the technical capabilities and operations of the most critical facilities and deaccessioning some facilities through sale or gifts."

Dr. Ford thanked Ms. Blakey for her presentation.

#### Audit, Finance & Analysis Committee Report

Dr. Ford introduced Mr. Robert Hanisee, Chair of the Audit, Finance & Analysis Committee. Mr. Hanisee reported on the briefing given to the Committee by Ms. Dot Swanson, JSC Chief Financial Officer (CFO). Mr. Hanisee described how uncertainty over Constellation puts JSC in a dilemma because cancellation remains subject to Congressional approval, and until that occurs the contractors are required to continue to work. At the same time, the Centers have to begin planning to make termination agreements with the contractors. JSC alone has \$2.5B in funding for FY 2011-2012 for closing out and transitioning the Constellation program. Ms. Swanson told the Committee that they are deferring as much as possible until they can figure out what the real directive to the Agency will be. He updated the Council on the Shuttle transition and described the impact on major Space Shuttle Program (SSP) facilities from the transition. He presented a chart showing hundreds of thousands of line items for property transferred or to be transferred from the SSP to Constellation, and he described how the Shuttle transition has been coordinated with Constellation transition planning. He reviewed a plan vs. actuals chart showing the SSP workforce dropping from over 12,000 to zero from 2008 thru 2011, a chart on Shuttle contractor layoffs, and summarized SSP Human Capital activities to date for the Shuttle transition.

Mr. Hanisee updated the Council on NASA's earned value management (EVM). He explained that EVM is a tool that monitors, tracks, and assesses the cost and schedule progress for programs and projects. It is part of the comprehensive "plumbing" that NASA is installing to show it can improve delivering projects on time and within budget; it will help implement the General Accountability Office (GAO) High Risk Corrective Action Plan. He explained that the Centers are building EVM capability, but only JPL is American National Standards Institute/Electronic Industries Alliance (ANSI/EIA) – 748 compliant. Mr. Hanisee updated the Council on NASA's property valuation issue with its Inspector General and auditor Ernst & Young over the ISS and Statements of Federal Financial Accounting Standards (SFFAS) – 35, which is a new standard that amends the protocol for accounting for property, plant and equipment and allows NASA to use reasonable estimates for historical costs. He described how all Shuttle inventory will be rendered obsolete due to program completion, and will be revalued with a net realizable value of \$0. Mr. Hanisee updated the Council on NASA's unfunded environmental liabilities (UEL). He explained that

these are estimated expenses for future activities to clean up environmentally hazardous sites. He updated the Council on the financial statement audit and on NASA's efforts to be delisted from the GAO High-Risk Report. He reported that the GAO and the Office of Management and Budget are now satisfied with NASA's approach, but that NASA still must demonstrate progress in reducing cost and schedule overruns.

Dr. Ford thanked Mr. Hanisee for his presentation.

#### Commercial Space Committee Report

Dr. Ford introduced Mr. Brett Alexander, Chair, Commercial Space Committee. Mr. Alexander stated that over 50 people attended the last Committee meeting, demonstrating strong interest in Commercial Space. Since the last NAC meeting, the Committee held fact-finding meetings with the Commercial Orbital Transportation Services (COTS) partners, the Commercial Crew Development (CCDev) partners, other major aerospace primes, and other commercial space companies. The Committee received briefings from the ESMD on exploration research and development, and on commercial cargo and crew. It was briefed by the Space Operations Mission Directorate (SOMD) on the Shuttle, the ISS, the 21<sup>st</sup> Century Launch Complex, and Launch Services. Additional briefings were received on Human Spaceflight, ISS Utilization, Crew Transportation, the ISS as a National Lab, and the ISS Commercial Resupply Contract. The Committee was also briefed by Col. Eileen Collins, Chair, Space Operations Committee.

The Committee believes that the COTS program could be a viable model for the Commercial Crew program. Mr. Alexander explained that NASA has entered into Space Act Agreements under COTS with SpaceX and Orbital Sciences to develop and demonstrate commercial capabilities for the delivery of cargo to the ISS. SpaceX has passed critical design review and is expected to conduct the first of three demonstration flights within the next several months. The other participant, Orbital Sciences, is undergoing critical design review and will conduct its only demonstration mission next year. Both contractors are behind their proposed schedules. Dr. Ford explained that the reason for the delay may have something to do with how optimistic they were in their original estimates. Mr. Alexander reviewed a chart showing the variety of contracting models that are available. Col. Collins stated that an important consideration to bear in mind about the ISS is the crew time that is needed for every docking. Dr. Ford explained that docking presents two issues: the impact on microgravity experiments and the crew distraction.

Mr. Alexander presented a proposed Observation that COTS is moving forward at a deliberate pace. The Council approved the following Observation: "The Commercial Orbital Transportation Services (COTS) program to develop and demonstrate commercial capabilities for the delivery of cargo to the International Space Station is moving forward at a deliberate pace. The Commercial Space Committee intends to closely follow the progress of the COTS Cargo program and the use of the proposed \$312 million in new funding allotted to "incentivize" the program's participants. The Committee respectfully requests that NASA keep it informed of developments on the program."

Dr. Ford thanked Mr. Alexander for his presentation.

#### Education & Public Outreach Committee Report

Dr. Ford introduced Mr. Miles O'Brien, Chair, Education & Public Outreach Committee. The Committee discussed NASA Television. It has a problem and they know they have a problem. The Public Affairs budget at Headquarters has been zeroed out for several years and this seems to be related to the problem. Mr. O'Brien discussed NASA's "Summer of Innovation" program for children. It may not reach its goal to reach 100,000 middle school students this year. Mr. O'Brien stated he is looking into raising private funding to fly kids on a Zero-G aircraft as an award for excellence. He discussed the need to do forward messaging as interest in the last Shuttle flight develops.

Mr. O'Brien presented a proposed Council Recommendation on the need to include the Communications and Education Office in mission planning. The rationale for the recommendation is that public access to missions should always be a priority requirement that is built into the design of any mission. The Council approved the following Recommendation: "The Council recommends that representatives of the Communications and Education Offices be included in reviews during all phases of development to ensure that missions serve NASA's educational and public outreach goals."

Mr. O'Brien presented a proposed Council Recommendation on the need to provide a budget for the Communications and Education Office. The Council approved the following Recommendation: "The Council recommends that the Communications and Education Office be funded at a level proportionate and appropriate to its mission, goals, and objectives in engaging the public."

Dr. Ford thanked Mr. O'Brien for his presentation and adjourned the meeting for the day.

#### *April 29, 2010*

##### Call to Order and Announcements

Dr. Ford called the meeting to order and briefly summarized the presentations from the previous day.

Ms. Rausch informed the Council members that their materials could be mailed to them.

##### Exploration Committee Report

Dr. Ford introduced Mr. Richard Kohrs, Chair, Exploration Committee. Mr. Kohrs introduced Ms. Betty Siegel, who is the Committee's new Executive Secretary. He described the guidance that NASA has given to ESMD on the Constellation program: they are to proceed with work already underway unless it can be deferred and restarted without significant impact, proceed with work obligated but not costed, and continue incremental funding of existing contracts. He described ESMD's approach to the President's FY 2011 budget request. Ten teams have been set up. Six deal with pre-formulating new or expanded programs: Commercial Crew and Cargo Development Program, Exploration Precursor Robotic Program, Enabling Technology Development and Demonstrations Program, Heavy Lift Propulsion Technology Program, and Human Research Program. One team is assessing the transition of the Constellation Program, and three are engaged in cross-cutting for international opportunities, exploring ways to ensure maximum public participation in NASA missions and ensuring integration and coordination across all ESMD programs. Mr. Kohrs discussed several challenges that ESMD has identified: stability and the new direction to plan a Crew Rescue Vehicle (CRV) without funding identified; funds for Orion; moving forward with Constellation cancellation plans per the President's FY 2011 budget, while maintaining compliance with FY 2010 Congressional appropriations and the Anti-Deficiency Act; the transition of contracts, workforce, facilities, and hardware; and the implications that may come with a Congressional Continuing Resolution.

Mr. Kohrs presented a proposed Council Observation applauding ESMD's efforts to respond to the President's guidance. The Council approved the following Observation: "The Council applauds the efforts of Associate Administrator Doug Cooke and his team in efforts to re-vector activities within ESMD in light of Presidential guidance."

Mr. Kohrs presented a proposed Council Observation regarding the threat the Orion CRV poses to the present ESMD plan and a proposed Council Observation about the absence of human exploration development projects. Dr. Ford explained that the failure to separately fund the Orion CRV could have a significant impact on the technology development program because technology always becomes the piggy-bank. The Council deliberated the proposals, decided to combine them, and approved the following Observation: "With the cancellation of the Constellation Program, we observe that there are no active human exploration development programs or projects. What remains instead are commercial LEO activities and enabling technologies that are required to underpin a variety of potential future exploration missions. Care should be taken that the new requirement for the Orion CRV not encroach on the present ESMD technology plan."

Dr. Ford thanked Mr. Kohrs for his presentation.

##### Information Technology (IT) Infrastructure Committee Report

Dr. Ford introduced Gen. Albert Edmonds, Chair, IT Infrastructure Committee. Gen. Edmonds briefed the Council on the Committee's activities. The Committee received presentations on IT security operations, heard a update from the Avionics, Software and Cybersecurity Subcommittee (ASCS), had a status report on NASA's high performance computing infrastructure, the upcoming IT Summit, and IT governance. He

noted that technology is moving so fast that if you do not have a plan to systematically upgrade your IT, your infrastructure can easily become outdated.

Next Gen. Edmonds briefed the Council on cyber security at NASA. He noted that NASA probably receives more attacks than any agency other than the Defense Department. Between 2007 and 2009, NASA averaged one billion vulnerability scans of its network perimeters on a monthly basis. Threat actors scanning NASA may be criminal groups, ankle biters, script kiddies, hacktivists, and nation states. The number of incidents has doubled from 1,120 incidents between FY 2007 and 2008, to 2,844 incidents between FY 2008 and 2009. The threat actors exploited vulnerabilities using well known threat actions and vectors: web applications that have common security vulnerabilities; spear phishing, with email as a vector; phishing, and social engineering as a secondary vector; as well as exploitation of improper configurations of computers and network devices as the vector. Gen. Edmonds reported that NASA's foremost IT risk management entity, the IT Security Division is developing an all-sources IT security risk assessment. The assessment focuses on three risk impact areas: data loss, disruption to enterprise services, and disruption to mission operations.

Gen. Edmonds reported on high performance computing at NASA. Gen. Edmonds briefly made the Council aware of the extensive power requirements associated with high performance computing. He also showed slides depicting the combination of high performance computing and high performance networking enabling interactive collaboration of geographically remote research groups.

Next Gen Edmonds discussed the Committee's revised work plan. Gen. Edmonds described how IT security at NASA differs from other Agencies. On the negative side, NASA has a very high number of separate systems subject to security systems. On the positive side is NASA's leadership, technical skills, and sense of urgency. He noted that NASA's Security Operation Center has acted smartly putting together NASA's infrastructure; he explained that you want to take a holistic approach to protecting your IT infrastructure. Correcting each isolated problem is very costly; you want a domain-wide solution whenever possible. Dr. Ford observed that the current best thinking on this subject is that very homogenous systems are remarkably vulnerable and that it may be a positive that NASA's systems are such a "hodgepodge."

Gen. Edmonds discussed possible findings that the Committee may be recommending. Between \$10-\$12M is currently being spent on security compliance reports. He asked what was the source of the need for so much reporting and wondered if some of it was self-inflicted. He indicated that the Committee will be looking at this issue.

Gen. Edmonds said that the Committee will use best practices to help NASA be more secure. First, they are doing "missionary work" and must engender trust. Ms. Dyson observed that the situation is fascinating, predictable, and appalling and asked when was the last time that NASA's IT security was reviewed. Dr. Ford explained that it happens frequently as with all Federal agencies. He observed that what Gen. Edmonds is trying to do is special and does not happen much in government. Ms. Dyson stated that if this was a public company she'd sell the stock immediately, but that it is great that this is being done; however, it should be done at all deliberate speed. Dr. Ford explained that NASA is not the worst or the best in this area and that most of its vulnerability lies in its openness, which will increase with expanded public participation; that is why it is so important that this group have a subgroup that operates at the classified level. Ms. Dyson explained that being open helps prevent intrusions because protection is designed in. Gen. Edmonds agreed.

Dr. Ford thanked Gen. Edmonds for his presentation to the Council.

#### Science Committee Report

Dr. Ford introduced Dr. Wes Huntress, Chair, Science Committee. Dr. Huntress briefed the Council on recent science missions and showed a series of slides.

1. The Solar Dynamics Observatory (SDO) is now in operation. SDO will be addressing the mystery of how the sun's 5000K degree surface can heat its atmosphere to millions of degrees. It is believed to be produced through plasma processes that are yet to be described fully.

2. A composite picture of the ash cloud from the Eyjafjallajökull volcanic eruption in Iceland obtained by the Ozone Monitoring Instrument (OMI) and the Moderate Resolution Imaging Spectroradiometer (MODIS) Earth-observing instruments in collaboration. Dr. Huntress noted that the data helped decision makers to determine whether to open or close airports in Europe.
3. A new tool for earth science: the unpiloted Global Hawk. Its advantages are its low cost, its ability to fly as high as the U-2, and its ability to spiral down and back up through the atmosphere, making it very useful for vertical profiles.
4. A radar image indicates possible recent volcanism on Venus.
5. An image from the Mars Reconnaissance Orbiter captured the results of a giant landslide caused by an impact event in the last two years.
6. An image from the Hubble shows an object being trailed by a debris field believed to be from a collision of two asteroids in the Main Belt.
7. An image shows for the first time a meteor that was discovered before it impacted Earth and the pieces of the meteorite recovered after the fall.
8. A radar image of a giant methane lake in the shape of a footprint on Titan.
9. An image from Hubble that shows a brown dwarf star with what may be a planetary object orbiting it.
10. Recent results from the Herschel Space Observatory, a European mission enabled by the U.S. supplied far infrared detector technology.
11. An image from NASA's Fermi gamma ray telescope capturing the first extragalactic object taken in the gamma ray spectrum. It shows huge radio-emitting lobes where electrons are being energized to emit x-rays.

Dr. Huntress reported that the James Webb Space Telescope has passed its Critical Design Review (CDR).

Dr. Huntress described the status of Earth Science projects in four mission classes: Foundational, Decadal Survey, National Needs, and Climate/Operational. He explained that the FY 2011 budget helps to resolve funding issues for those missions, but expressed concern that the new requirement to fund Orion might come from this source. He described international collaborations with the European Space Agency, Japan, Germany, Argentina, France and Brazil. He noted that NASA held a bilateral meeting with the China National Space Administration (CNSA) on a data exchange agreement for Chang'e and the Lunar Reconnaissance Orbiter (LRO). The State Department approved this activity.

Dr. Huntress reported that Mr. Mark Uhran, Assistant Associate Administrator for ISS Utilization in SOMD, had briefed the Science Committee on using the ISS for science experiments. The ISS is not in an ideal orbit for science, its atmosphere is dirty and it is acoustically noisy. There are some niche uses however, particularly for technology experiments, and the Science Committee is investigating the utility of the ISS for earth and space science. SOMD has been providing help to scientists who want to use the ISS. SMD has been inviting proposals for instruments to fly on the Station in their low cost mission flight lines such as Explorers. Some proposals have been received, but have not yet survived peer review. There are opportunities for transportation to the ISS and the costs are minimal. In response to a request by Ms. Blakey for clarification on the cost for transporting experiments to the ISS, Dr. Huntress explained that SMD would have to pay for integration costs only, not for the transportation service itself. Dr. Huntress explained different mechanisms for getting experiments to the ISS. In response to a question from Col. Collins about the Window Observational Research Facility (WORF), which is the only window on the ISS with optical quality, Dr. Huntress explained that information about the facility is described in a manual being distributed by Mr. Uhran. Dr. Ford requested that the manual be distributed to the Council members.

In response to a request from Dr. Huntress, Dr. Ford explained the difference between a Council Observation and a Council Finding.

Dr. Huntress presented a proposed Council Observation on resolution of the plutonium issue. In response to a question from Ms. Blakey, he explained that plutonium is needed to fuel radioisotope thermoelectric generators (RTGs) for space missions to the outer planets. The U.S. stopped making plutonium and has run out of stock. NASA has been buying it from the Russians and it is uncertain whether the Russians have enough to meet NASA's needs. The price has gone up and a decision has been made to restart production

in the U.S. by the Department of Energy (DOE). The main problem has been funding. The Council approved the following Observation: "The NAC is grateful for the current resolution of the Pu-238 production issue with DOE."

Dr. Huntress presented a proposed Council Observation on the revival of NASA's technology programs. The Council approved the following Observation: "The NAC is encouraged by the excellent planning for revival of NASA's technology programs, including plans for a technology flight test program."

Dr. Huntress presented a proposed Council Finding on the Kepler Telescope data policy. He explained that there had been a problem involving the exclusive period for using proprietary data and that the Astrophysics Subcommittee had proposed a compromise. Dr. Ford noted that this is a good use of the "finding" mechanism. The Council deliberated revisions to the language and approved the following Finding: "The Council concurs with the Science Committee's endorsement of the recommendation from the Astrophysics Subcommittee on revising the Kepler data policy and supports its implementation." Dr. Huntress presented a proposed Council Finding on the roadmap for taking humans into deep space. This proposed finding was deferred at Dr. Ford's suggested until further clarification is obtained.

Dr. Ford thanked Dr. Huntress for his presentation.

#### Space Operations Committee Report

Dr. Ford introduced Col. Eileen Collins, Chair, Space Operations Committee. Col. Collins described the Committee's recent activities. She briefed the Council on utilization of the ISS and noted that science in the National Lab is the number one priority in the Committee's work plan. They will be looking at it from an operational point of view; another committee will be addressing science. The number two priority will be the transition. Col. Collins presented slides showing some of the great work taking place on the ISS. Col. Collins discussed the objectives for research on the ISS and reviewed a slide showing how the ISS research portfolio has matured as assembly was completed. Dr. Huntress noted that Mr. Uhran indicated that there is increasing interest in ISS utilization and there may actually be a bidding war for its assets.

Col. Collins described the constraints for science on the ISS. She explained that a six-member crew on the ISS allows 70 hours per week, total, for the crew to work on research. That does not include assembly and tear-down. Col. Collins feels this number should be monitored and will increase as experience is gained. Mr. Alexander added that it is only 35 hours from the U.S. side. Col. Collins explained that downmass, how researchers get their stuff back, is a problem. They need access to the data, particularly experiments involving humans, as soon as the astronauts return to Earth. After the Shuttle retires, upmass will be provided by Progress, Soyuz, ESA's new Automated Transfer Vehicle (ATV), Japan's H-II Transfer Vehicle (HTV), SpaceX and Orbital. Downmass will be provided by Soyuz and SpaceX.

Col. Collins presented a proposed Council Recommendation to ensure that ISS capabilities are more widely known. Dr. Ford observed that the ISS story is a remarkable one of international cooperation and engineering that has not been well disseminated. Col. Collins stated that NASA can't advertise the ISS's availability; that can be done by commercial partners. Mr. O'Brien described it as "B to B". Col. Collins added that NASA needs help from outside NASA. Ms. Dyson requested a description of the problem. Dr. Ford explained that exploring the reasons for which advertising is forbidden is a red herring that can be set aside; what is at the heart of the Recommendation is a desire to communicate the Station's success and the best way to do that is through the media. Ms. Dyson asked whether third party services could be considered. Dr. Ford agreed that was part of the solution; however, the Recommendation needs to have a broad scope and not excessive specificity. There is a need to let people know that there is an opportunity to use the ISS. Ms. Blakey observed that industry would welcome this opportunity. She noted that this topic was one of the best sessions on the Hill. Dr. Kennel observed that two major events that should get global attention are the Shuttle's retirement and the 14-nation accomplishment to build the ISS. Dr. Kennel stated that there should be some announcement that the ISS is open for business. Dr. Ford advised that the Recommendation needs to be broad enough to give NASA flexibility. Mr. O'Brien asked how this information is getting out. Dr. Ford responded that NASA has staff doing this. The Council approved the following recommendation: "The Council recommends that NASA make the ISS capabilities,

achievements, and potential services more widely known outside the NASA community, especially within the business world. Consideration should be given to new and innovative mechanisms for doing so.”

Col. Collins discussed the issues involved in the Space Shuttle transition and retirement. It requires the careful planning, optimized utilization, and responsible disposition of processes, personnel, resources, and real and personal property, focused upon leveraging existing Shuttle and ISS assets for the safe and successful execution of NASA’s future programs. She explained that NASA is doing a very good job using the remaining Shuttle flights to transport logistics that are needed on the ISS. She observed that the Space Shuttle program is flying safe, successful missions and has gotten much safer and continues to improve. It is not the same system that flew previously and she extended “kudos” to them. She noted that the last Shuttle flight will be in November or December, at which time the workforce will drop down to zero. The Committee is concerned about losing those technical skills. Col. Collins met with the Commercial Space Committee and offered comments to the commercial providers through that Committee. They should read about the lessons learned that are discussed in the Challenger Accident Investigation Board (CAIB) report. She noted, with approval, that the commercial providers have been attending the Flight Readiness Review (FRR) and Mission Management Team (MMT) processes. She stated that encouraging common interfaces on hardware is important from the operational side. The Council discussed the Orion CRV and was unable to resolve whether it would involve a land or water recovery. Col. Collins observed that both must be planned for because there could be a launch abort. Dr. Ford stated that from a operating cost point of view, he would be surprised if the commercials used a water landing because the at sea recovery is not cheap and that the exposure to salt water is damaging to the capsule. Mr. Kohrs recommended that it be done in the safest manner. Col. Collins explained that a primary potential problem with landing on land is tumbling. Dr. Ford indicated that the NAC had recently explored this issue in depth, but only in the context of the Constellation Program. He noted that at that time there was not consensus among the NAC members as to whether water or land landings were to be preferred.

Col. Collins presented a proposed Council Recommendation on developing flight operations concepts for commercial operations and future human exploration beyond LEO. At Dr. Ford’s request, this item was deferred until additional information could be obtained.

Col. Collins presented a proposed Council Recommendation on developing an operational model for commercial space vehicles. Mr. Alexander expressed concern about forcing commercial companies to use a particular system. The Council approved the following Recommendation: “Develop an operational model for commercial space vehicles that will allow NASA flight resources and crews to be committed to commercial space systems.”

Col. Collins presented a proposed Council Recommendation on developing an operational plan for the Commercial Resupply Service (CRS) firms. Dr. Ford stated that he would be shocked if this has not already been done. Col. Collins suggested asking for a briefing on it and Dr. Ford concurred. Action on the proposed Recommendation was deferred.

Col. Collins presented a proposed Observation on the need for integrated transition planning. After substantial deliberation, Dr. Ford recommended that the item not be sent forward at this time and it was withdrawn.

Dr. Ford explained that at Mr. Bolden’s level, the national policy is still in flux. Dr. Huntress observed that there is no existing human spaceflight project beyond LEO at this time, and there is nothing to show what is next. Dr. Ford concurred and also agreed that it is needed. Gen. Edmonds counseled that nothing contractually could be done until a decision has been made. Mr. Alexander explained that the issue is specificity—the previous Administration had identified a specific destination, while the current Administration is giving direction notationally in a budget release. Dr. Ford advised that NASA is trying to get clarity. Mr. O’Brien observed that this is what happens when a sea change is announced in a budget document.

Dr. Ford thanked Col. Collins for her presentation.

Technology and Innovation Committee Report

Dr. Ford introduced Ms. Esther Dyson, Chair, Technology & Innovation Committee. Ms. Dyson observed that the way to have people be innovative and committed is to have their work be used. She explained that you want innovation everywhere, but you want to make the distinction between risky innovation in research and development, and the need for as near total safety as possible when you are sending humans into space. You need both cultures to work together, but you have to make sure that the safety, “no tolerance for failure” attitude doesn’t infect the research. You have to make sure the researchers know that when supporting humans in space, their hardware or software must work. That is an interesting challenge.

Ms. Dyson presented a proposed Council Finding supporting the “push” model for developing disruptive space technologies. She opined that Dr. Braun is a huge asset to NASA, and that the Committee’s role is to support and guide him. She described the NASA Technology Executive Council (NTEC) process. Its job is to help make transitions happen as well as to help set the priorities for and deal with the inevitable resource, responsibility, location, and personnel conflicts as things move from research to actually being mission critical. Dr. Ford explained that a Finding implies that something has been studied and a conclusion has been reached. The Council approved the following Finding: “The Council strongly supports the newly defined “push” model for the development of disruptive space technologies and the NASA Technology Executive Council process for managing and prioritizing future NASA technology investments. Among other things, the Council likes the openness of the technology research calls being proposed by the Chief Technologist.”

Ms. Dyson reported on a recent briefing by the JSC Space and Life Sciences Directorate (SLSD) on its system for innovation. SLSD has issued a solicitation for Open Innovation Service Providers (OISP) and made awards to two innovative companies, InnoCentive, and Yet2.com. SLSD also has conducted an open source competition through the Harvard Business School. Ms. Dyson explained the three key components to the SLSD system for innovation: an evidence-based risk management system; a portfolio mapping of gaps to determine optimal collaborative strategy; and a strategic system to drive innovation.

Ms. Dyson presented a proposed Council Recommendation on the importance of life and physical sciences research in future human exploration. Dr. Ford suggested revising it to make clear it addresses the topic of life and physical sciences. Ms. Dyson explained that the concern is that this field does not get lost in the Agency. Dr. Ford advised that the Recommendation should not suggest that the subject matter’s management necessarily be consolidated in one particular place. Dr. Huntress suggested using the phrase “coherent management” to show it is intended to be cross-cutting. Dr. Kennel observed that you have to gain the respect of the commercial, scientific, and operational communities simultaneously for this to work. The Council approved the following Recommendation: “The Council recognizes the importance of life and physical sciences research in future human exploration activities and urges the Agency to engage in deliberative and inclusive discussions about how to manage it coherently across the NASA organization.”

Ms. Dyson presented a proposed Council Finding on embracing innovation in non-traditional areas. The concept is that innovation applies to more than research and engineering. For example, creativity can be applied to produce innovative procurement practices. The Council approved the following Finding: “The Council believes that NASA should continue embracing innovation in process areas within NASA such as business and acquisition practices, and external partnerships. The Technology & Innovation Committee was particularly impressed with the Space Operations Mission Directorate’s innovative flight hardware service contract with Hamilton Sundstrand for water production services on ISS and encourages additional similar innovations along these lines or other new approaches.”

Ms. Dyson presented a proposed Council Recommendation urging NASA to engage with other Government agencies in developing new technology programs. She explained that this provides budget protection for NASA and the nation as a whole to the extent that the same thing does not have to get developed twice. Mr. Alexander advised that the Defense Department should not be singled out and Dr. Ford concurred. The Council approved the following Recommendation: “The Council strongly urges NASA to quickly engage with other Federal Agencies and Departments as it develops its new technology programs.”

Ms. Dyson presented a proposed Council Recommendation for NASA to share personnel between NASA Centers and other organizations. Dr. Ford explained that the Intergovernmental Personnel Act (IPA) is one of the best innovation tools that NASA or any agency has because it is often through the infusion of new talent that agencies are able to innovate and accomplish technology transfer with universities and other organizations. The Council approved the following Recommendation: "The Council encourages NASA to engage in cross-fertilization of personnel between NASA Centers and between NASA and outside organizations through Intergovernmental Personnel Act agreements and rotational assignments as a way of encouraging innovation as the Agency plans and implements its new technology programs and in general." The title for the recommendation will be changed to "Encouraging Diversity of Thought."

Dr. Ford thanked Ms. Dyson for her presentation.

#### Ad-Hoc Task Force on Planetary Defense

Dr. Ford introduced Mr. Rusty Schweickart and Dr. Tom Jones, Co-Chairs of the Task Force on Planetary Defense. Mr. Schweickart reported that NASA's FY 2011 budget for the Near Earth Object (NEO) research augments the NEO Observations Search project by \$16M per year, to accelerate progress on the detection of NEOs less than 1km in diameter. This represents an increase from \$4M to \$20M per year. In response to a question from Mr. Alexander, Mr. Schweickart stated that the Task Force has only engaged in fact-finding to date and is not ready to make a recommendation on the funding level; however, what makes sense is more than \$16M. The \$4M had been used almost entirely to fund discovery, tracking, cataloging and characterizing of objects greater than 1km in diameter. He noted that NASA has responsibility for these tasks pursuant to existing authorizing legislation. He discussed the National Research Council's (NRC) NEO Report. It is not a final report; however it has been released to NASA. Dr. Jones noted that Congress had directed the NRC to produce the report and give the results to NASA. The NRC examined how best to accomplish the Congressional goal assigned to NASA for the search program. Congress has also tasked the NRC to consider the alternatives for diverting an object found heading towards the Earth. The Report forms a substantial body of work on which the Task Force will rely and supplement. Mr. Schweickart discussed activities at the United Nations regarding the NEO threat. Dr. Jones and Mr. Schweickart have been working with the UN Committee on the Peaceful Uses of Outer Space (COPUOS) over the past five years as members of the Association of Space Explorers. Action Team 14 of COPUOS is working on coordinating the international decision process for taking action when there is a recognized threat. COPUOS is considering those recommendations for presentation to the General Assembly. The State Department represents the U.S. at the forum, and NASA provides technical support. It is anticipated that the results will reach the General Assembly in two to three years.

Legislation enacted in 2008 directs the White House Office of Science and Technology Policy (OSTP) to recommend assignments of responsibility for planetary defense within the U.S. Government. The legislation requires OSTP: (i) to develop a policy for notifying Federal agencies and relevant emergency response institutions about an impending NEO threat if near term public safety is at risk; and (ii) to recommend a Federal agency or agencies to be responsible for protecting the U.S. from a NEO, and for implementing a deflection campaign in combination with international bodies. Mr. Schweickart stated that these are key issues that overlay everything else. The recommendation is due October 2010. The NRC has recommended that an inter-governmental committee be established and appropriate responsibility be assigned.

The Task Force was briefed on the Augustine Commission deliberations concerning NEOs as an exploration candidate destination and part of the flexible response path for exploration. ESMD briefed the Task Force on the robotic precursor mission planning efforts.

Ms. Dyson asked what Earth should come together to do. Mr. Schweickart explained that while NASA should have a major role, there are geopolitical issues that involve national policy discussions and decisions above NASA's level. Civil defense and evacuations are not within NASA's purview. The UN is looking at a world-wide disaster management community that would receive a warning. He stated that when you talk about prevention, you are looking at the space agencies around the world. He emphasized that there is a misperception that responsible action is very expensive. Dr. Ford explained that the Task Force was not a permanent body and would continue as long as needed and desired by NASA. It is not a NAC Committee

and does not bring recommendations or findings. Fact-finding is its product and it will prepare a report for the NAC, which will review it and send it forward.

Dr. Huntress asked whether the Department of Defense (DoD) should have a role when it comes to mitigation. Dr. Ford responded that while the Task Force will look at the DOD position, it is a NASA task force and the Administrator needs advice on how to respond to his responsibility in this area. Dr. Jones noted that a member of the Task Force comes from military space. Col. Collins expressed concern that having the DOD involved will raise questions concerning the militarization of space. Mr. O'Brien asked what the other nations were doing. Mr. Schweickart responded that the information is being coordinated through the NEO action team at the UN. Dr. Jones added that the money being spent worldwide is a fraction of NASA's annual \$4M expenditure.

Mr. O'Brien asked for suggestions on how to educate the public. Dr. Jones stated that the public understands that there is a problem, but perhaps does not fully appreciate the scale of the challenge. Mr. Schweickart added that there was a recent international workshop in Mexico City on establishing a functional communications capability coordinated internationally. Dr. Kennel suggested that the most difficult problem is "what do you tell the public and when do you tell them." He asked whether we know enough about detection and hazard assessment to know what a reasonable monitoring program would be. He professed surprise at how little is known about the subject. Mr. Schweickart stated that it would be essential for the Task Force to give the NAC a basic background briefing. Dr. Ford agreed and requested briefings on detection and mitigation, as well as interim reports. Ms. Dyson expressed concern that the public might give up caring about important matters due to fear over an asteroid strike and suggested that Mr. O'Brien's Committee had a lot of work to do. Mr. Schweickart suggested that the world would welcome NASA leadership. Dr. Ford recommended that the NAC members read the NRC study.

Ms. Dyson noted that the State Department is eager to find areas for cooperation with Russia. Dr. Jones commented that it is encouraging that Mr. Perminov, the head of Russia's space agency, mentioned an asteroid deflection demonstration in a winter 2010 speech and recognizes the hazard posed to Earth. Mr. Schweickart remarked that Mr. Perminov also used the phrase "international cooperation." In response to a request from Col. Collins, Mr. Schweickart referred her to the JPL web page (<http://neo.jpl.nasa.gov/risks/>) to learn the number of potentially hazardous asteroids discovered to date. Dr. Jones observed that we are aware of around 7,000 NEOs and that about 20 percent are potentially hazardous. The key parameters are their size and detectability. Dr. Ford noted that the next NAC meeting will be at JPL in August and requested a briefing on the NEO detection program. .

#### Public Input

Dr. Ford announced that the NAC had finished hearing from its 9 committees and its Task Force. He thanked all the Chairs and Co-Chairs for a job well done. He then invited any members of the public that might wish to provide any input to the Council to please come to the microphone. No members of the public elected to speak.

#### Council Roundtable Discussion & Wrapup

At this point, Dr. Ford reminded the Council about the dates for the next two meetings. On August 4-6, the Council will meet at the Jet Propulsion Laboratory in Pasadena, CA and then on October 5-7, the Council will meet at NASA's Dryden Flight Research Center - in the Mojave Desert, CA.

Dr. Ford then asked the Council if there were any final remarks for the good of the order? Hearing none, he then thanked the members of the public for their interest and attendance yesterday and today. He also thanked the staff of NASA Headquarters, the NAC support staff (particularly Diane Rausch, Marla King, and Mary Floyd), and the Committee/Task Force Executive Secretaries, for all the support in making this very productive and fruitful meeting possible. And in particular, he offered sincere thanks to all of the Members of the NASA Advisory Council, for taking time out of their busy schedules to participate in our quarterly meeting.

Having completed the Council's business for this meeting, Dr. Ford announced that the minutes and presentations from the meeting would be available on the NAC website in the near future.

He again thanked everyone for their participation and wished them safe travels home.

Adjournment

Dr. Ford adjourned the meeting.

**NASA ADVISORY COUNCIL****NASA Johnson Space Center  
Houston, Texas****PUBLIC MEETING****April 28-29, 2010  
Gilruth Conference Center - Lonestar Room****Agenda****Wednesday, April 28, 2010**

8:00 – 8:02 am	Call to Order, Announcements	Ms. Diane Rausch, Executive Director NASA Advisory Council, NASA HQ
8:02 – 8:10 am	Remarks by Council Chair	Dr. Kenneth Ford, Chair NASA Advisory Council
8:10 – 8:30 am	Welcome to NASA Johnson Space Center	Mr. Michael L. Coats, Director NASA Johnson Space Center
8:30 – 9:00 am	Remarks by NASA Administrator	Mr. Charles F. Bolden, Jr. NASA Administrator
9:00 – 10:00 am	NASA Workforce - Recent NASA Hiring Patterns	Ms. Toni Dawsey & Mr. Stephen Chesley Office of Human Capital Management NASA HQ
10:00 – 10:15 am	Break	
10:15 – 11:15 am	NASA Office of Chief Technologist	Dr. Bobby Braun Chief Technologist NASA HQ
11:15 am – 12:15 pm	Aeronautics Committee Report	Ms. Marion Blakey, Chair
12:15 – 1:15 pm	Lunch (Council Only)	
1:15 – 2:15 pm	Audit, Finance & Analysis Committee Report	Mr. Robert Hanisee, Chair
2:15 – 3:15 pm	Commercial Space Committee Report	Mr. Brett Alexander, Chair
3:15 – 3:30 pm	Break	
3:30 – 4:30 pm	Education & Public Outreach Committee Report	Mr. Miles O'Brien, Chair
4:30 – 4:45 pm	Public Input	
4:45 – 5:00 pm	Council Roundtable Discussion	

5:00 pm                      Adjourn

**Thursday, April 29, 2010**

8:00 am	Call to Order	Ms. Diane Rausch, Executive Director NASA Advisory Council
8:00 – 8:02 am	Announcements	Dr. Kenneth Ford, Chair NASA Advisory Council
8:02 – 9:00 am	Exploration Committee Report	Mr. Richard Kohrs, Chair
9:00 – 10:00 am	IT Infrastructure Committee Report	Gen. Albert Edmonds (Ret.), Chair
10:00 – 10:15 am	Break	
10:15 – 11:15 am	Science Committee Report	Dr. Wesley Huntress, Chair
11:15 am – 12:15 pm	Space Operations Committee Report	Col. Eileen Collins (Ret.), Chair
12:15 – 1:15 pm	Lunch (Council Only)	
1:15 – 2:15 pm	Technology & Innovation Committee Report	Ms. Esther Dyson, Chair
2:15 – 2:35 pm	Ad-Hoc Task Force on Planetary Defense	Mr. Rusty Schweickart, Co-Chair Dr. Thomas Jones, Co-Chair
2:35 – 2:50 pm	Public Input	
2:50 – 3:00 pm	Council Roundtable Discussion & Wrapup	All
3:00 pm	Adjourn	

NASA ADVISORY COUNCIL MEMBERS  
April 27, 2010

Dr. Kenneth M. Ford, Council Chair <i>Founder and Director, Florida Institute for Human and Machine Cognition (IHMC)</i>	Mr. Richard Kohrs, Chair, Exploration Committee <i>NASA (Ret.)</i>
Ms. P. Diane Rausch, Executive Director <i>Designated Federal Official NASA Headquarters</i>	Dr. Wesley T. Huntress, Jr., Chair, Science Committee <i>Director, Geophysical Laboratory, Carnegie Institute of Washington</i>
Ms. Marion Blakey, Chair, Aeronautics Committee <i>Chief Executive Officer, Aerospace Industries Association</i>	Colonel Eileen M. Collins, USAF (Ret.), NASA Shuttle Pilot and Commander (Ret.) Chair, Space Operations Committee <i>Aerospace Consultant, President of Space Presentations, LLC</i>
Mr. Robert M. Hanisee, Chair, Audit, Finance and Analysis Committee <i>Managing Director, Trust Company of the West</i>	Ms. Esther Dyson, Chair, Technology and Innovation Committee <i>EDventure Holdings</i>
Mr. Brett Alexander, Chair, Commercial Space Committee <i>Executive Director, Commercial Spaceflight Federation</i>	Dr. Raymond S. Colladay, Ex-Officio Chair, Aeronautics and Space Engineering Board, National Academies
Mr. Miles O'Brien, Chair, Education and Public Outreach Committee <i>Miles O'Brien Productions</i>	Dr. Charles F. Kennel, Ex-Officio Chair, Space Studies Board, National Academies

## MEETING ATTENDEES

### *NASA Advisory Council:*

Ford, Kenneth, Chair	Director, Florida IHMC
Rausch, P. Diane, Executive Director	NASA Headquarters
Alexander, Brett	Commercial Spaceflight Federation
Blakey, Marion	Aerospace Industries Association
Collins, Eileen	Space Presentations, LLC
Dyson, Esther	EDventure Holdings
Edmonds, Albert	Edmonds Enterprises Services, Inc.
Hanisee, Robert M.	Trust Company of the West
Huntress, Wesley T, Jr.	Carnegie Institute of Washington
Kohrs, Richard	NASA (retired)
O'Brien, Miles	Miles O'Brien Productions
Kennel, Charles F., Ex-officio	SSB, National Academies

### *NASA Attendees:*

Bolden, Charles	NASA Headquarters
Braun, Bobby	NASA Headquarters
Chesley, Stephen	NASA Headquarters
Coats, Michael	NASA/JSC
Cooke, Doug	NASA Headquarters
Dawsey, Toni	NASA Headquarters
Emond, John	NASA Headquarters
King, Marla	NASA Headquarters
Mathis, Dylan	NASA Headquarters
Minor, Susan	NASA Headquarters
Nado, Kathy	NASA Headquarters
Palacios, Tina	NASA Headquarters
Pellis, Neal R.	NASA/JSC
Pyle, Brady	NASA/JSC
Seigel, Bette	NASA Headquarters
Veight, Imanda	NASA Headquarters
Vick, Erika	NASA Headquarters

### *Other Attendees:*

Brown, David L.	ESCG
Carreau, Mark	Aviation Week & Space Technology
Faulconer, Walt	APL
Frankel, David	Harris Corporation /consultant
Jones, Tom	NACPlanetary Defense Task Force
Lawrence, Carl	MEI
Schweickart, Rusty	NAC/Planetary Defense Task Force
Siders, Jeff	Orbital Sciences

LIST OF PRESENTATION MATERIAL

- 1) Investments in the Future: NASA's Technology Programs [Braun]
- 2) Aeronautics Committee Report [Blakey]
- 3) Audit, Finance, and Analysis Committee [Hanisee]
- 4) Report of the Commercial Space Committee [Alexander]
- 5) Education and Public Outreach Committee [O'Brien]
- 6) NASA Advisory Council Exploration Committee [Kohrs]
- 7) Information Technology Infrastructure Committee Report [Edmonds]
- 8) Science Committee Report [Huntress]
- 9) NASA Advisory Council Space Operations Committee [Collins]
- 10) Task Force on Planetary Defense [Schweickart and Jones]